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# SOCIETY OF ARTS.

**FRIDAY, SEPTEMBER 30th, 1853.**

## ON CHINESE HOROLOGY, WITH SUGGESTIONS ON THE FORM OF CLOCKS ADAPTED FOR THE CHINESE MARKET.

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The American Patent-office, as our readers are perhaps aware, does not confine its duties to the mere business of granting patents, but in addition endeavours to collect information on the subject of inventions and industrial progress in every part of the world. For this purpose, the American Consuls in each of their districts are charged with the duty of reporting to the authorities at home everything that may be calculated to be useful to home industry. The following is taken from a report of this kind, and as the subject is one which is equally important to our own countrymen in a manufacturing point of view, it has been thought desirable to print the greater portion of it, believing that it will be found useful as a guide to those connected with the trade, as well as interesting to the general reader. The report, after stating the circumstances under which it is made, proceeds as follows :

In a manufacturing point of view, although there is much less to repay research, yet there are some branches of industry in this department the investigation of which could not fail to bring valuable facts to light; and if no more can be done than to point out defects in Chinese labour, which our artizans can supply, that alone would prove mutually advantageous to the two great nations on the opposite shores of the Pacific.

Clockmaking, which forms the subject of this note, is a case in point; and it is believed that, with a modification to be suggested, American clocks can be made an article of extensive import into China. For a long period the importation of clocks and watches, chiefly the former, into this country from the continent of Europe, was valued at little short of half a million of dollars annually. This trade has nearly ceased, partly owing, no doubt, to the rapid impoverishment by the opium traffic, and partly to the fact that native manufacturers are able to compete with foreigners. Yet clocks are not often met with in China; they are generally confined to the public offices, where it is common to find half a dozen all in a row. The number annually manufactured cannot be large, for in the richest cities in China clockmakers are not numerous. At Nankin there are 40 shops; at Suchau, 30; Hangchau, 17; and at Ningpo, 7; the average number of men employed in each being less than four, who are mostly occupied in repairing watches and clocks. The cheapest clock they make costs 7 dollars: some are worth as much as 100 dollars, the most common price being about 25 dollars each. A manufacturer estimates the number of clocks made at the above prices at 1,000 per annum; and probably 500 more would more than cover the whole annual manufacture of the empire. A few watches are made, the chain and spring being the only parts that are imported. The oil used by Chinese workmen to abate friction appears to be particularly adapted for that purpose, though expensive; it is obtained from the flowers of the *Olea fragrans*.

Before describing the kind of clock which seems adapted for this market, a brief glance at the history of the horological art in China may not be inappropriate. It had its rise, as in the western side of Asia, in the clepsydra.

Assuming—what is in the highest degree probable—the authenticity and accuracy of the Shuking, we find that, forty-five centuries* ago, the Chinese had occupied themselves with the construction of astronomical instruments somewhat similar to the quadrant and armillary sphere, and the observations they made with them, even at that remote period, are remarkable for their accuracy, enabling them to form an useful calendar. The present cycle of sixty was adopted at that time by Hwangti (2697—2957 B.C.) To this emperor is attributed the invention of the clepsydra. The instrument at that period was probably very rude, and not used as a timepiece, but for astronomical purposes, in the same manner as employed by Tycho Brahe, for measuring the motion of stars, and subsequently by Dudber in making maritime observations. It was committed to the care of an officer of rank, styled, Clepsydra Adjustor.

The greatest philosopher in Chinese history anterior to Confucius was Duke Chau, the alleged inventor of the compass. He appears, also, to have been the first to employ the clepsydra as a timepiece. He divided the floating index into one hundred equal parts or "kih." In winter, forty kih were allotted to the day and sixty to the night, and in summer this was reversed. Spring and autumn were equally divided. This instrument was provided with forty-eight indices, two for each of the twenty-four terms of the year. They were consequently changed semi-monthly—one index being employed for the day, and another for the night. Two were employed every day, probably, to remedy in a measure the obvious defects of all clepsydras—of varying in the speed of their rise or fall, according to the ever-varying quantity of water in the vessel, which might be done by having the indices differently divided. To keep the water from freezing in winter, the instrument was connected with a furnace, and surrounded by heated water. Chau flourished eleven centuries before our era. The forms of the apparatus have been various, but they generally consisted of an upper and a lower vessel, always of copper, the former having an aperture in the bottom, through which water percolated into the latter, where floated an index, the gradual rise of which indicated successive periods of time. In some this was reversed, the float being made to mark time by its fall. A portable one was occasionally employed in ancient times, on horseback, in military tactics. Instruments constructed on the same principles with the above were in use among the Chaldeans and Egyptians at an early period—that of Ctesibius, of Alexandria, being an improvement over those of more ancient times. The invention of Western Asia was doubtless wholly independent of that of the East, both being the result of similar wants. Clepsydras were subsequently formed of a succession of vessels communicating by tubes passing through dragons, birds, &c., which were rendered still more ornamental by the indices being held in the hands of genii.†

The earliest application of motion to the clepsydra appears to have been in the reign of Shuenti (126—145 A.D.), by Tsianghung, who constructed a sort of orrery representing the apparent motion of the heavenly bodies around the earth, which was kept in motion by dropping water. There is reference, also, to an instrument of this description in the third century. In the sixth century, an instrument was in use which indicated the course of time by the weight of water, as it gradually came from the beak of a bird, and was received into a vessel on a balance, every pound representing a kih. About this time mercury began to be employed instead of water, which rendered the aid of heat in winter unnecessary. Changes were made, also, in the relative number of kih for day and night, so as to vary with the seasons.

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* Chronology.—Although doubts may exist respecting the absolute accuracy of Chinese chronology, it must nevertheless be admitted that it is so far correct as to render arguments founded on the commonly received chronology altogether untenable; and it is a matter of regret, therefore, that the latter has been followed, in their Chinese publications, by all Romish and Protestant missionaries. I cannot too earnestly urge the adoption of Hale's Chronology, and that speedily, lest in the mean time some Chinese Celsus or Porphyry should arise and bring objections against our faith not easily answered to the satisfaction of their countrymen.

† Drawings of two of the numerous forms of these instruments are given in the Report, taken from an old astronomical work.

As in Europe, monks of the Roman church devoted considerable attention to mechanical inventions, especially in the construction of instruments for measuring time for the regulation of their worship and vigils; in like manner, also, Buddhist monks in their silent retreats, but at an earlier period, similarly occupied themselves, and for the same purposes. Several instruments, designed as time-pieces, the invention of priests, are mentioned in Chinese history. They present nothing novel, however, with the exception of one, which is nothing more than a perforated copper vessel placed in a tube of water, which gradually filled and sunk every hour, requiring, of course, frequent attention. Although their knowledge of hydrodynamics has ever been very limited, the Chinese appear to have been the first to devise that form of clepsydra to which the term water-clock is alone properly applied; that is to say, composed of apparatus which rendered watching unnecessary, by striking the hours. Until the commencement of the eighth century, the persons employed to watch the clepsydra in palaces and public places, struck bells or drums every kih; but at this period a clock was constructed, consisting of four vessels, with machinery, which caused a drum to be struck by day, and a bell by night, to indicate the hours and watches. No description of the works of this interesting invention can be found. It is possible, however, that the Saracens may have anticipated them in this invention of water clocks.

In the history of the Tong dynasty (620-907), it is stated that in the Fahlin country (which in this instance doubtless means Persia, though the best living authority amongst the Chinese makes it Judea), there was a clepsydra on a terrace near the palace, formed of a balance, which contained twelve metallic or golden balls, one of which fell every hour on a bell, and thus struck the hours correctly. It is not improbable that this instrument is identical with the celebrated one which the king of Persia sent in 807 to Charlemagne.

In 908 an astronomer, named Tsiang, made an improvement on all former instruments, and which, considering the period, was a remarkable specimen of art. The machine, which was in a sort of miniature terrace, was ten feet high, divided into three stories, the work being in the middle. Twelve images of men, one for every hour, appeared in turn before an opening in the terrace; another set of automata struck the twelve hours, and the kih, or eighths of such hours. These figures occupied the lower story; the upper story was devoted to astronomy, where there was an orrery in motion, which it is obvious must have rendered complex machinery necessary. We are only told that it had oblique, perpendicular, and horizontal wheels, and that it was kept in motion by falling water.

As the Saracens had reached China by sea at the close of the eighth century, and by land at an earlier period, some assistance may have been derived from them in the construction of this instrument, but I am disposed to consider it wholly Chinese. Beckman, after much learned research, ascribes the invention of clocks to the Saracens, and the first appearance of these instruments in Europe to the eleventh century. Mention may here be made of other instruments of the same description, also constructed about this period. One (which, like the last, united an orrery and clepsydra) was formed in one part like a water-lily, whilst in another were images of a dragon, a tiger, a bird, and a tortoise, which struck the kih on a drum, and a dozen gods, which struck the hours on a bell, with various other motions, besides a representation of the revolution of the heavenly bodies. The machinery of another of these was moved by an under shot water-wheel; its axis was even with the ground, and consequently the frame containing it was partly below the surface. The motions of the sun and moon, stars and planets, were made to revolve around a figure of the earth, represented as a plain from east to west. Images of men struck the hour, and its parts. In this, however, as in all the aforenamed instruments, the sounds struck were always doubtless the same, as the Chinese do not count their hours. Another machine was constructed, which also represented the motions of the heavenly bodies. It was a huge, hollow globe, containing lights, and perforated on its surface, so as to afford in the dark a good representation of the heavens. This also was set in motion by falling water. Subsequently to this, various machines are mentioned; but the brief notices given afford nothing of interest until we approach the close of the Yuen dynasty, the middle of the fourteenth century. Shungtsing, the last of the race of the great Genghis Khan (who is depicted in history as an effeminate prince, and as having the physiognomy of a monkey), was evidently a man of great mechanical skill; and to the last, when his dominions were slipping from him, and confusion reigned everywhere, he amused himself by making models of vessels, automata, and time-pieces. His chief work was a machine, contained in a box seven feet high and half that in width, on the top of which were three small temples. The middle of these temples had fairies holding hororary characters, one of whom made her appearance every hour. Time was struck by a couple of gods, and it is said they kept it very accurately. In the side temples were representations of the sun and moon respectively, and from these places genii issued, crossing a bridge to the middle temple, and after ascertaining as it were the time of day from the fairies, returning again to their quarters. The motions in this case were, it is thought, effected by springs. An instrument somewhat similar is described as an ornament in the palace of the capital of Corea. It was a clepsydra with springs, representing the motions of the celestial orbs, and having automata to strike the hour. Since the introduction of European clocks, clepsydras have fallen into disuse. The only one, perhaps, in the empire is that in the watch-tower of the city of Canton. It is of the simplest form, having no movements of any kind, but it is said to keep accurate time.

In dialling, the Chinese have never accomplished anything, being deficient in the requisite knowledge of astronomy and mathematics. It is true, the projection of the shadow of the gnomon was carefully observed at the earliest historic period; but this was for astronomical purposes only.* Proper sun-dials were unquestionably derived from the West, but they were not introduced, as Sir J. F. Davis supposes, by the Jesuits. The Chinese are probably indebted to the Mahomedans for this instrument; although we find an astronomer endeavouring to rectify the clepsydra, by means of the sun's shadow projected by a gnomon, about a century earlier than the Hegira. There is a sun-dial, in the Imperial Observatory at Pekin, above four feet in diameter. Smaller ones are sometimes met with in public offices. These were all made under the direction of missionaries of the Roman church, or their pupils. From remote antiquity, a family named Wang, residing at Hiuning, north latitude, 29° 53′, longitude E. G. 118° 17′, in the province of Canhwui, has had the exclusive manufacture of pocket compasses, with which sun-dials are often connected. In most of these, a thread, attached to the lid of the instrument, serves as a gnomon, without any adaptation for different latitudes, although they are in use in every part of the empire. Another form, rather less rude, is employed by clockmakers for adjusting their time-pieces; it is marked with notches, one for each month in the year, to give the gnomon a different angle every month. The Chinese instrument exceeds that of Corea in every respect.

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* It was by a gnomon that the ancient Chinese endeavoured to ascertain the centre of the earth. A measurement of the length of the solstitial shadow, made at Loyang, on the Yellow River, 1,200 B.C., was found by Laplace (quoted by Humboldt, in "Cosmos," vol. ii., p. 115) to accord perfectly with the theory of the obliquity of the ecliptic, which was only established at the close of the last century.

Time is not unfrequently kept by igniting sticks, the combustion of which proceeds so slowly and regularly as to answer for temporary use tolerably well.

Hour-glasses are scarcely known in China, and only mentioned in dictionaries as instruments employed in western countries to measure time. A native writer on antiquities, says: "The Western priest, Limatau (M. Ricci), made a clock which rendered and struck time a whole year without error." The clock brought out by Ricci, if not the first seen in China, is the earliest of which mention is made in Chinese history. They subsequently became an article of import; and, as already mentioned, this branch of trade was at one time of considerable value. Clocks and watches of very antique appearance are often met with—specimens of the original models, scarcely to be found in any other country. Some of the latter, by their clumsy figure, remind one of their ancient name, "Nuremberg eggs;" but their workmanship must have been superior to that of most modern ones, or they would not be found in operation at this late day.

The Chinese must have commenced clockmaking at an early period, as none now engaged in the trade can tell when or where it originated; nor can it be easily ascertained whether their imitative powers alone enabled them to engage in such an undertaking, or whether they are indebted to the Jesuits for what skill they possess. It is certain, the disciples of Loyola had for a long time, and until quite recently, in their corps at Pekin, some who were machinists and watch-makers. One of these horologists complains, in "Les Lettres Edifiantes et Curieuses," that his time was so occupied with the watches of the grandees, that he had never been able to study the language. Doubtless, the fashion which Chinese gentlemen have of carrying a couple of watches, which they are anxious should always harmonise, gave the fathers constant employment. A retired statesman of this province has published a very good account of clocks and watches, accompanied with drawings representing their internal structure in a manner sufficiently intelligible.

The Chinese divide the day into twelve parts, which are not numbered, but designated by characters, termed, rather inaptly, horary. These terms were originally employed in forming the nomenclature of the sexagenary cycle (2657 B.C.), which is still in use. It was not until a much later period that the duodecimal division of the civil day came into use, when terms to express them were borrowed from the ancient calendar. The same characters are also applied to the months. The first in the list (meaning son) is employed at the commencement of every cycle, and to the first of every period of twelve years; and also to the commencement of the civil day at 11 P.M., comprising the period between this and 1 A.M. The month which is designated by this term is not the first of the Chinese year, but singularly enough it coincides with January. Each of the twelve hours is divided into eight kih, corresponding to quarter hours. This diurnal division of time does not appear to have been in use in the time of Confucius, as mention is made in the spring and autumn annals of the ten hours of the day, which accords with the decimal divisions so long employed in clepsydras, the indices of which were formerly divided into one hundred parts. A commentator of the third century of our era, in explaining the passage relating to the ten hours, adds a couple more; but even at that time the present horary characters were not employed.

The form* I would recommend as suitable for the dial-plates of clocks manufactured for this market is as follows: An outer circle, with small characters as numerals, exactly corresponding to the Roman figures on western clocks; an inner circle, containing the twelve horary characters, and within these the signs for noon, evening, midnight, and dawn. In the horary circle large single characters should be placed, to represent whole hours, and small double ones half hours, equal to a whole European hour.

Let the minute hand extend to the inner part of the outer circle, and make twelve revolutions in a diurnal period. The hour hand should reach to the inner edge of the horary characters, and make one revolution in the same period of time. Let the pendulum vibrate seconds as now, and the minute hand, at the expiration of sixty seconds, make half a revolution. It should strike from 1 to 12 A.M. and P.M., and correspond in this respect to European clocks. It will be understood, then, that at our even hours the short hand will point to a large horary character—the middle of a Chinese hour—and the long hand will be directly upward; and at our odd hours the former will be opposite the small characters which point the commencement of their hour, and the latter will point directly downward, or at the 12 P.M. of our clocks. Or to repeat the same in another manner: At 1 o'clock P.M., our reckoning, the hour hand will be half-way between the large characters on the top and the next one to the right; and the minute hand, having made half a revolution, will point perpendicularly downwards, and the clock strike one. At the expiration of another of our hours, a whole Chinese hour will have expired when the former hand will have reached the first large character to the right, and the latter be directed to the zenith, the clock striking two.

After this perhaps unnecessary minute description of what is wanted in the machinery, a few words remain to be added respecting the instrument as a whole. In the first place, it should be well made. A few worthless ones would damage the business irreparably. They should be brass, and placed in frames of wood, which will not be easily affected by atmospheric changes. Common pine-wood, veneered with mahogany, have answered well. Spring clocks will not succeed. Some of this description, sent from New York, cannot be kept in repair; whilst a quantity of clocks, moved by weights, manufactured chiefly in Connecticut, imported into China about seven years ago, have proved good time-pieces, and give no trouble. With regard to external appearance, on which so much depends, I would advise that in every case there be as much of the works exposed as possible, through an opening in the dial-plate. A Chinaman not only wishes to see what he is buying, but what is going on in his instruments when bought; and, as his countrymen have the merit of being extreme utilitarians, mirrors in the lower part of the door will be generally preferred to any other ornament. Some, however, should be ornamented at this point, for the sake of variety; and perhaps nothing would please more than such a grouping of objects by the artist as would represent a river, bringing into view a steamboat and a sloop, and on the banks a railroad, locomotive, and cars, a steepled church, or a many-storied hotel in the distance, and a stage-coach also. Or another interesting device would be afforded by a representation of the solar system, but this would need to be accompanied with several Chinese characters.

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* A diagram is given in the original, which may be seen at the Society's House, on application to the Secretary.

It is of primary importance that a particular description of the manner of using the clock, the mode of putting it up, setting it off, winding up, and regulating, should be given. These directions, which should be more minute than if designed for English readers, can be translated and printed very easily in this country. But there would be no difficulty in printing the directions by means of wooden blocks in the manufactory at home. In copying the characters for the dial, extreme care is requisite that every stroke and each line should be represented exactly as given in the diagram. Astronomical characters or descriptions of any kind which may be needed by individuals trying the experiment of clock-making for China, I shall furnish most cheerfully, for the privilege of increasing the utility of the instrument, by introducing with them a few passages of sacred Scripture.

It may be asked, why, if such a clock be needed by the Chinese, they have never constructed one for themselves? It is certainly marvellous that they should manufacture clocks, including dial-plates, and always employ Roman figures, and follow the reckonings of foreigners, which so few of them are able to comprehend, and which by all are considered mysterious and outlandish. It is only to be accounted for on the ground of their limited inventive abilities, and high powers of imitation. That a time-piece of this description would be in demand in China, I am perfectly satisfied from inquiries made of natives in various quarters. Chinese merchants say that they should be retailed at about five or six dollars each. If I recollect rightly, they can be made in Connecticut at 2 dolls. 50 cents, which would afford sufficient profit both for the mechanics and merchant.

## REMARKS BY COL. CHESNEY, R.A., ON THE TUBULAR OR DOUBLE LIFE-BOAT, INVENTED BY H. RICHARDSON, ESQ., OF ABER-HIRNANT.*

*Communicated through the Secretary of the Royal Geographical Society.*

It seems strange that the use of life-boats in Great Britain should appear to be of so recent a date, for as far as I have been able to ascertain, the first patent was granted to Mr. Lukin, in 1785, for one which had a projecting gunwale, hollow cases, or double sides, and air-tight lockers or inclosures under the thwarts to secure buoyancy.

As this boat was liable to be disabled by having the sides stove in, a committee of gentlemen at South Shields offered a reward in 1788 for a more perfect model, and one that may be considered the parent life-boat, was produced in consequence by Mr. Greathead, in 1789, which was floated in 1790. A curved bottom, like the section of a wooden bowl, was chosen for the boat, under the belief that she could *scarcely* upset, and that she could not remain bottom upwards if she did so. A craft was thus constructed of 30 feet in length, 10 feet beam, and 3 feet 4 inches in depth. She was lined with cork throughout, and rowed 10 oars, double banked, and was steered by an oar at each extremity. Thirty-one boats were built of this construction, and it is stated that up to 1804 nearly 300 persons were saved by their means.

In the year 1800 several contrivances with reference to the conversion of ships' boats into life-boats were brought forward by the Rev. Mr. Bremmer, Minister of Walls and Flota, Orkney. The plan which proved the most successful, and for which a medal was given, was the securing a cask in the bow of the boat upon a bed of cork, with another similarly attached to the stern, and thus producing the necessary buoyancy. An improvement on the preceding was brought forward by Wilson, of London, in 1807. His boat was a modification of that of Mr. Lukin, the projecting gunwales in his case being divided into separate compartments, so that if one of them should be beaten in by striking against a rock, the others might still remain serviceable.

Water-tight boxes were next suggested by Browne in 1817, and about this period a decided advance was made by the late Ralph Watson, Esq., of the Treasury, who proposed the use of a number of copper tubes, which being placed along the deck beams of any vessel, would secure a life-raft even when the wreck was taken to pieces.

In 1824, a steam life-boat was prepared by Sir William Hillowey, Bart., the hull of which was to be filled with cork, and the boilers protected by the same means from an influx of water.

In 1829, Lieutenant Ansell recommended the use of bags of well-tanned sheepskin, which were to be kept in store and inflated for use when required, to give buoyancy to any boat that might need additional power; but a much more efficient system was in 1837 given to the world by Captain Rorie, namely, an array of copper tubes or joints of bamboo, to be placed like those of Mr. Watson under the seats of life-boats, so as to render them safe and serviceable in cases of shipwreck. But it does not appear that this plan was ever brought into general use, and the state of our life-boat system has remained lamentably defective.

To give impulse to invention, and with the noble design of preventing disaster, His Grace the Duke of Northumberland offered a prize for a life-boat which would fulfil certain conditions — those of self-righting and freeing herself of water, being considered of the greatest importance. The liberality of His Grace produced 360 models of boats, 50 of which were selected by the Admiralty Life-boat Committee as being worthy of a place in the Great Exhibition.

Without attempting to describe these numerous specimens, it may be mentioned that one is the tubular, which will presently be noticed; the other was invented by Mr. Harbord, of Hull, with the specific objects of self-righting and freeing herself from water, and was constructed of copper. Her length was to be 20 feet, keel 10 feet, depth 4½ feet, sheer of gunwale, 24 inches, and weight 19½ cwt., to row ten oars. But the prize was awarded to Mr. James Beeching, of Yarmouth, for a boat nearly the form of a whale-boat, 36 feet long, 9½ beam, depth

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* This communication has been slightly abridged.—*Ed.*

3½ feet, sheer of gunwale 36 inches, pulls 12 oars, and has for ballast a water-tank divided into compartments. A thick cork fender is placed outside, and extra buoyancy is secured by means of air-cases placed high in the bottom of the boat. It was supposed that this build possessed the cardinal qualifications of self-righting when capsized; but three disastrous occurrences—namely, at Lytham, Caernarvon, and Rhyl, have unfortunately proved the contrary; on one occasion eight, and on another six, persons having perished.

These calamities are merely mentioned, in order to show that no safe life-boat has as yet been adopted; and notwithstanding the liberal example of the Duke of Northumberland, it is to be feared that while the great necessity for efficient life-boats has become more and more apparent of late years, the spirit of encouragement has rather declined.

Soon after Mr. Greathead's life-boat was beginning to do some good service in the cause of humanity, a reward of 1,200*l.* was voted to him by Parliament in 1802; the Literary and Philosophical Society bestowed a reward on him at the same time; and the Royal Humane Society gave him their medallion. Nor was this all: the Corporation of the Trinity House awarded him 100 guineas; the Society of Arts their Gold Medallion and 50 guineas; and Lloyd's 100 guineas; and this body at the same time offered 2,000 guineas for the construction and establishment along the coast of suitable life-boats, and this in sufficient numbers, which, as we are all aware, is a desideratum still to be accomplished; for, so far from any efficient plan having been carried out, we find, from a statement of Capt. Washington, that in 1,500 miles of the Scottish coasts, there are only eight life-boats established, and that only seventy five are provided for 2,000 miles of the English coast, whilst eight life-boats are all that belong to Ireland. In bringing this lamentable deficiency before the public as well as the Government, Capt. Washington shows us, at the same time, that during the year 1850 there were 680 shipwrecks on the coast of Great Britain, and that 780 lives were lost. But, numerous as were these calamities at that period, they have greatly increased since 1850; for it appears from a recent calculation that 800 seamen perished on the east coast of England during the last calamitous winter, and an aggregate of 2,000 British seamen on our coasts elsewhere.

Hitherto, public bodies, such as the Trinity Board, the National Institution for the Preservation of Life from Shipwreck, the Shipwrecked Fishermen and Mariners' Royal Benevolent Society, have acted, and continue to act, separately in the good cause; but it is not going too far to express the belief that one centralised system would be more advantageous than the whole of these desultory efforts; and that all the power of the Government is desirable, and even necessary, in order to work out more efficiently a general plan (with, as a necessary part, more ample means) for the preservation of life from shipwreck. And since every British seaman contributes something annually (3*d.* a year) from his limited earnings for this purpose, he has a right to expect that the funds so raised should be turned to the best account.

The momentous question of efficient life-boats can only be safely dealt with after the most patient consideration, founded upon an extensive series of experiments, both as regards the construction of the boats to be adopted, and the encouragement to be given to their crews. As regards the latter, it may be here observed that the salvage is a reward to those who save a part of a ship's cargo; but if the chance of the latter be overlooked, in order to save life, there is no pecuniary reward for individuals who make this sacrifice.

I will now draw attention to the peculiar form of the boat, which dates from the year 1830, when a wreck at Weymouth, and the previous examination of Blanchard's pontoons, gave rise to the invention of the tubular life-boat, by Henry Richardson, Esq., of Aber-Hirnant, Merioneth, which has already successfully encountered the sea in almost every form. I need scarcely observe that Blanchard's pontoons are divided, both longitudinally and transversely, into several compartments, by partitions of tin, both to increase their strength, and to prevent them from being accidentally perforated in any part. Tubular boats are by no means modern: we have the flying praam of Anson, the outrigger or mosquito boats of the Cingalese and Malays, and others, seen by myself in Nubia, are built upon the same principle; and if water-tight compartments do not belong to Noah's ark itself, they have been actually in use for ages in the Chinese boats, and also in Europe in various ways. But, although the invention of the tube and water-tight compartment neither is, nor could be, claimed in this instance, the adaptation of them to the construction of a life-boat, is due to Mr. Richardson, and is a very important practical step toward the object we are so desirous of attaining. The first boat of this kind was built, as I have before said, in 1830; in 1831 three others were constructed, the largest to row 12 oars, and one so small that a child in petticoats was in the habit of rowing it alone at Weymouth, in the surf, in perfect safety. The subject dropped for years, until in 1850 Henry Thomas Richardson, Esq., then an officer in the 4th Dragoon Guards, and son of the above-named Mr. Richardson, caused a fifth to be built at Manchester.

When the Duke of Northumberland offered his prize, Mr. H. T. Richardson's model was one of those sent in; and although the prize was awarded to Mr. Beeching, so persuaded was he of the superiority of the tubular plan, that he caused the original of the present boat to be built. The boat is formed of two tubes of tinned iron, 40 feet in length by 2½ in diameter, tapering at either end, and meeting each other, thus giving the appearance of sheer. An iron frame work, securely rivetted, unites the whole into one mass, and the tubes having longitudinal bars of iron and hoops within, and iron heels running from end to end, they are divided into water-tight compartments, occupied by air-proof bags: a cork fender surrounds the whole fabric. The rowers and passengers are placed on a platform above the frame-work, which is surrounded by a light gunwhale, the height of the rowlocks. A rope passes along under the kelson for the purpose of towing; sliding-keels are proposed to be added, to give increased stability; she carries two lug-sails, topsails, and jib; steers, rows, and sails well. This boat was launched on the 15th January, 1852, but had scarcely been 24 hours on the Cheshire shore, when she was found to be wilfully damaged by having had holes driven into the different compartments of her tubes. After repair, she was submitted to the most trying experiments that could be devised. These were, landing her passengers and crew in a gale on a lee shore, and going off again; towing, in stormy weather, behind a steamer, without any one on board, the commander of the steamer having a *carte blanche* to upset, swamp, or tear her to pieces if he could. Having proved in all of them perfectly successful, Mr. H. T. Richardson circulated a challenge to the Shipwreck and other Societies, also to upwards of 50 life-boat stations on the coast of Britain; but *not a boat* came out to meet him. However, Mr. Beeching having expressed his readiness to meet her at Ramsgate with his prize life-boat, the tubular set sail, and, after a perilous voyage round the Land's-end, and encountering very severe weather on the way, reached that place on the 22nd of June, when they found, to their extreme surprise, that Mr. Beeching had disposed of his boat, and the *Challenger* remained unopposed the champion of the field.

On her voyage round from Liverpool to Woolwich, the tubular was at Plymouth subjected to various experiments in the presence of the Port Admiral Sir John Ommanney, alongside of the *Leander* frigate, as the following extracts from letters will show. These letters are from officers then serving in the *Leander;* their names are not given, as their permission has not yet been asked, though it is believed that they would have no objection :

> "I think *Challenger* the only thing built, at least that I have heard of, deserving the name of life-boat. That she has no capacity to retain water, that she cannot sink or capsize, was fully proved alongside the *Leander*, when eighty men on one tube only immersed it deeper without in any way affecting the safety of the boat or the people in her. From her having so ably fulfilled all the conditions of the challenge, and her capability in other respects, I would willingly take a boat of the same dimensions as one of our cutters or quarter life-boats at sea; and feel convinced many a valuable life would be saved had a ship such a boat belonging to her. She would also be of great service in landing in surfs, embarking troops or field pieces, and going up shallow rivers."
>
> "Again," writes another individual, "I witnessed one of the *most severe trials* that possibly could have been put to any boat in the world, and she *behaved admirably* when tried alongside H.M.S. *Leander*, June 5th, 1852."

Hitherto it has been found to be impossible to capsize the tubular boat, because the force of the sea passes off and through the two tubes; but if she were to be upset by any cause, her buoyancy would be greater than before, and she would, with trifling modifications, be a serviceable boat, and row, as will be proved, bottom upwards.

It may be added, in conclusion, that Mr. Richardson has recently expressed to the Shipwreck and Mariner's Benevolent Society, also to the National Institution for the Preservation of Life from Shipwreck, his readiness to meet any of their boats for the purpose of a trial, at any time and place between the Land's-end and John O'Groat's House, on the west coast of Ireland, between Cape Clear and the Causeway, and there to prove practically whether the tubular is or is not the best life-boat at present in use, as it would be the least expensive.

## NOTES ON TIN.

Mr. Layard, in his work upon Nineveh and Babylon, in reference to the articles of bronze from Assyria, now in the British Museum, states, that the *tin* used in the composition was probably obtained from Phœnicia; and, consequently, that *that* used in the Assyrian bronze may actually have been *exported* nearly *three thousand* years ago from the British Isles. The Assyrians appear to have made an extensive use of this metal; and the degree of perfection which the making of bronze had then reached, clearly shows that they must have been long experienced in the use of it. They appear to have received what they used from the Phœnicians. It is said that the Phœnicians were indebted to the Tyrian Hercules for their trade in tin ; and that this island owed to them its name of *Baratanac*, or Britain, the land of tin.

The Great Polgooth Tin Mine, in Cornwall, has been worked for tin from a period far too remote for the earliest record, and the histories of Cornwall have severally given it that notice to which it was entitled from its magnitude and importance. At least, from the time of the requirement of tin by the Phœnicians to the present, it has been wrought more or less, with short intermissions, and has yielded a greater quantity of ore than any other tin mine in the county of the same depth. In a geological point of view, it presents some of the most remarkable features known in the science of mining, and has not unfrequently baffled all the known theory and practice of the day; and from this reason mainly, whilst other mines have started into existence at a much more recent period, and have been profitably worked to a great depth, this mine has only yet reached to about 110 fathoms. The mine during the last sixty years has not been sunk one single fathom.

The following improvements in the processes of obtaining tin, have recently been published by Mr. F. W. Emerson, of the Trereiffe Chemical-works, Penzance.—The improvements consist in a means of purifying and separating the ore of tin from other metallic oxides, sulphurets, arseniates, tungstates, or other compounds, previously to its introduction into the smelting furnace, by digesting the ore (either with or without the aid of heat), in a mixture of common salt, sulphuric acid, and nitrate of soda or potash; the last of these not being absolutely necessary to the success of the operation, though it helps to shorten the time in which the process is performed. The inventor first makes a correct analysis of a fair sample drawn from the bulk of the ore to be operated upon, in order to ascertain the exact nature and amount of the impurities. In the event of its being found to contain any compound of sulphur or arsenic, he first roasts or calcines the ore by any of the ordinary known methods. This process is not necessary, unless such compounds are present. If it is found to contain oxide of tin—the ores of tin mostly occur as a peroxide—it will be necessary, in order to avoid loss, either first to peroxide it, or afterwards to precipitate from solution by the insertion of metallic zinc, or any other precipitating agent. To peroxidize the oxide of tin, he saturates the bulk of the ore to be operated upon with nitric or nitrous acid, and after allowing it to stand for two or three hours, to permit a full reaction to take place, he puts it into an iron, fire-clay, or other convenient retort, and distils or evaporates it to dryness, receiving the nitric or nitrous acid gases in stoneware or other convenient condensers, to be used over again. He then mixes the ore with such a quantity of common salt, as by decomposition with sulphuric acid shall yield a sufficient amount of muriatic acid to combine with the contained impurities of metallic oxides, or bring the oxides of iron and manganese in wolfram, or the lime in tungstate of lime, into a soluble state. He then puts the ore thus mixed with salt into a cistern formed of granite, slate, stoneware, or other material that is not seriously acted upon by acids (a wooden trough has been found to answer the purpose), and pours upon it such a quantity of either brown acid or oil of vitriol as will effect the decomposition of the salt. The inventor prefers to use an excess of sulphuric acid. He then turns into the mixture a jet of steam from a steam-boiler, so as to keep the said mixture at about 200° Fahr., stirring it about from time to time with a wooden rake or shovel, so as to expose fresh surfaces to the action of the reagents, adding a small quantity, say six or seven pounds to the ton, of nitrate of soda or potash, for the purpose of enlivening and quickening the operation. If the material should contain micacious or magnetic iron ores, it would be advisable to increase the amount of nitrate of soda or potash, to assist their oxidation and conversion. The invention also describes analogous methods of treating the ores when copper or tungstate is contained.

It may further be stated, that an important mineral discovery has recently been made at St. Ives, Cornwall For some time past traditions have been entertained respecting the existence of a very rich tin lode somewhere on the shore, at about half-tide on the beach at the back of St. Ives. Latterly these have been revived, and a few days since, a party, consisting of about forty working miners and mine agents, after securing the proper grants, combined to try and search for it. They have been well rewarded by discovering an extraordinarily rich east and west tin lode, composed principally of killas, about two feet wide, with veins of very rich tin ore running through it; the lode is very similar to those in West Providence.

## BERDAN'S GOLD MACHINE.

This is an American invention for crushing, washing, and amalgamating gold and other ores, which has, for some time past, been attracting much attention both in the United States and in this country. As the great progress which is making in gold discovery gives importance to appliances for its reduction, the following description of this machine may be interesting to the readers of this Journal.

Its construction is simple. It consists chiefly of a large cast iron basin, about 7 feet in diameter, set at a moderate incline, upon a central shaft, which revolves in suitable bearings. In this are placed two large iron balls, one weighing two and a half tons, and the other about one ton. To the under part of the basin is attached a furnace of conical form. The whole receives motion by means of simple gearing from any suitable power. The operation is as follows: Fire is made in the furnaces, quicksilver is placed in the basin, and the auriferous ore thrown in. The basin is then set in revolution; the balls, by their gravity revolving in a direction opposite to that of the basin, and at the same time receiving a spiral or tortuous movement from their contact with one another. The ore passes under the balls, and is crushed to powder. This crushing is effected at the lowest point in the basin, and below the surface of the mercury, which, with its affinity greatly enhanced by heat, seizes upon the gold the moment it is exposed. The refuse powder rises to the surface of the mercury, whence it is carried off in the form of a thin paste, by a small stream of water, which runs in at the upper side of the basin, and escapes through suitable openings, or scuppers, just below its rim, into a trough, by means of which it may be collected and preserved for analysis, if desired.

The machine depends for its efficiency upon both mechanical and chemical novelties. The rolling and grinding motion, produced by the combination of the inclined basin and the loose balls, is well adapted to the complete crushing of whatever may be brought under its operation; while the application of heat, to increase the affinity between the metals, is, on a large scale at least, believed to be new. The amalgamation takes place with energy at the moment of liberation, and at the point of crushing beneath the surface of pure and heated mercury. This machine is said to extract all the gold contained in the ores which are submitted to its action. No opinion need be expressed upon its merits, as it is said that an opportunity is, in a few days, to be afforded to all members of the Society of Arts who feel an interest in the subject, to witness its actual operation at the Windsor Iron Works, Windsor-terrace, City-road, where it is now in process of erection. A paper upon the subject, illustrated by a model and diagrams, is in course of preparation, and will be presented to the Society early in the approaching session.

## AMERICAN MACHINERY.

The *New York Tribune* thus notices three useful inventions, now displayed at the American Great Exhibition:

" A shoe-pegging machine is exhibited by A. T. Gallahue, of Pittsburgh, Pennsylvania, patented on the 18th of last month. The inventor states that no other machine for pegging boots and shoes is in operation, and we do not remember having seen any, though long ago satisfied, by observing the operation of other machinery, that pegging by machines is practicable. This one is made almost entirely of iron, costs 150 to 200 dollars, and will probably weigh some 200 or 300 lbs. It works very quietly and rapidly, and will peg a shoe or a boot, two rows on each side (leaving a small space at the heel and toe) in three minutes, cutting its own pegs. One man only is required to operate it, without auxiliary power. A good workman will peg a shoe by hand in fifteen minutes, but close application to pegging is considered unhealthy. We asked an Eastern shoe manufacturer, who examined this machine when we did, whether it did its work better or worse than it is done by hand, and he said it drove the pegs more evenly, and on the whole, better. We understand that it is now in practical operation in Pittsburgh; but we believe no other than the one in the Exhibition has yet appeared on this side of the Alleghanies.

" A machine for making cots, or little leathern rolls used in spinning (and of which 20,000 per day, hitherto made by hand, are worn out in Massachusetts alone), is one of the most ingenious contributions of Connecticut to the Fair. Those who are familiar with Whittemore's machine for cutting, bending, and setting card-teeth, or the machine for making chains of brass or other wire, invented at Derby, Connecticut, will readily anticipate its best points. The leather is drawn into the machine in the shape of a strap or belt, is cut off at the proper length diagonally, so as to form the best edges for gumming, is then rolled or doubled over so that the two edges, being gummed in the operation, exactly meet; when they are pressed firmly together, and the now perfected cot dropped through the machine, and another length drawn in to undergo the same process.

" A weighing and packing machine, for packers of tea, coffee, pepper, spices, &c., &c., is exhibited by Slater and Steele, Jersey City, which seems excellent in its sphere, though that sphere is a narrow one. The material is fed from a hopper over head, is weighed in its descent from the hopper, and discharged in pounds, half-pounds, or otherwise as may be required, into a tunnel resting in a square box, into which a paper has already been conveyed by the machine. The box forms one link in an endless chain of boxes revolving around a platform, and moving on a few inches, receives through the tunnel a square stamp just fitted to it, and thence passes to another and another, until the fourth delivers it pressed into a solid mass and enveloped.

## INGENIOUS APPLICATION OF SCIENCE AND THE RESULTS.

A very ingenious application of scientific principles to determine the point of fusion in a closed vessel, and a remarkable result from high pressure on fluids, were incidentally mentioned by the President of the British Association in his inaugural address. Experiments were instituted by Mr. Hopkins, Mr. Fairbairn, and Mr. Jowle, to determine the effect of increased pressure in raising the temperature of fusion. The substance operated on was inclosed in a very strong metal chamber, and the pressure was produced by water forced by a plunger acted on by a long lever down an iron tube, three quarters of an inch thick. Wax was the substance employed; and it was of course essential to ascertain the exact moment that it became fluid when heat was applied. As all the apparatus must necessarily be opaque, the melting point could not be seen. The difficulty was ingeniously surmounted in the following manner: a small magnet was enclosed on the top of the wax, whilst outside the metallic chamber containing it, and on the same level, a nicely-balanced magnetic needle was placed. The enclosed magnet acted on the needle and deflected it, at a certain angle, from its natural position; but the instant that the wax melted, the magnet fell to the bottom, and the vibration of the needle immediately indicated the fact. It was thus ascertained that under a pressure of thirteen thousand pounds on the square inch, wax requires thirty degrees additional heat to melt it; about one-fifth of the whole temperature at which it melts under the pressure of the atmosphere.

During the experiment, it was observed that the plunger gradually descended in the tube, and on examination it was discovered that the water had, under the influence of the enormous pressure, been forced through the pores of the iron, though three-quarters of an inch thick. On afterwards examining the tube closely with a lens, not the least opening could be seen by which the water could have escaped. This result far exceeds that of the celebrated Florentine experiment, by which the incompressibility of water was supposed to be proved by its forcing a passage through the pores of a globe of silver, very thin in comparison with the three-quarter inch iron tube. It was not ascertained whether any of the melted wax had been forced into the pores of its containing vessel.

## LEATHER WITHOUT BARK.

The *Gardeners' Chronicle* of Saturday says: — We fear that we have unwelcome news for our friends whose interests are concerned in woodland property. The low price of British timber, excepting oak, has long been a serious misfortune to them, enhanced by the declining price of bark, even when cured upon a more rational plan than that employed by some of the gentlemen managing the Royal forests. But now it would appear as if bark itself was likely not to be worth the stripping.

It was stated in the *Mechanics' Magazine*, of September 18th, 1852, that a Mr. Preller had taken out a patent for preparing skins with materials of which bark formed no part. He used, on the one hand, vegetable substances, consisting largely of starch, and containing little gluten, such as barley flour, rice flour, or even starch itself; on the other, butter, milk, grease, and other fatty animal matters; to which he added salt or saltpetre in certain proportions. With this mixture, skins prepared in the usual manner are smeared, after which they are agitated in a revolving cylinder for a certain length of time, when they quickly become ready for the currier.

In a late number of the same publication it is stated, that "this method of treatment is so remarkable for its originality, and attended with such excellent advantages in the course of manufacture, and in the character of the produced article with reference to the requirements of practice, as to promise nothing short of a complete revolution in the arts of the tanner, and the establishment, to a certain extent, of new criteria by which the alities and value of leather for practical purposes are henceforth to be estimated. A large factory in Lant-street, Southwark, has been fitted up by Mr. Preller, and he is there carrying on his manufacture to a very considerable extent, and with a degree of success which could hardly have been supposed would attend his efforts in the comparatively short time which has elapsed since he began. His leathers have already acquired a high reputation in the market, and are rapidly getting into favour for a variety of manufacturing purposes, especially for driving bands, for which their superior strength, flexibility, uniformity of texture, and durability, render them eminently serviceable."

The difference in quality of the skins thus treated and such as have been tanned with oak bark, catechu, or similar substances, is represented to be strikingly in favour of the patent process.

The peculiar merits of Preller's method are said to be these. It reduces the weight of leather, and at the same time increases its strength; and this takes place to such a degree that "it has been found that oak-tanned leather of 3-8ths of an inch in thickness is incapable of resisting a strain which Preller's leather, 1-4th of an inch in thickness, will resist in constant working. A strip of it a yard long, about half an inch in width, and 1-8th thick, gave way with a breaking weight of 6 cwts 20 lbs.; while ox-hide, well tanned on the oak-bark system, and of the same dimensions, could only resist a strain of 5 cwt. As another illustration of the superior strength of Mr. Preller's leather for driving-bands, we may mention a circumstance which was told us at the factory, that on one occasion, to lengthen a driving-band made of his own leather, he added to it a piece of oak-tanned, and that the latter gave way in the performance of its work. Sheep-skins, kid-skins, and some other species of leather, which in general may be torn asunder in the hands with the exercise of only a small degree of force, acquire in this process a strength which is quite surprising, of which we had experience ourselves when a piece of split sheep-skin, of large size, was put into our hands, and we were requested to try to break it."

Another great advantage in Preller's process is represented by the same authority to consist in saving time in the process of preparing. "The thickest ox-hide requires only two days and a half to be fully converted by the application of this process, of which Mr. Preller showed us an example in the hide of a large prize ox exhibited at the late cattle show. Under the most favourable circumstances, it now requires four or five weeks' subjection to the tanning liquor. Under the old process of tanning, in which the hides were placed in the pit, with layers of tan to separate them, and afterwards filled with water, a very considerable period has been known to elapse during the process; sometimes amounting to four years. This old-fashioned method has not been yet completely abandoned for more scientific ones, and contrasted with it the great change which this invention has effected is the more remarkable. The walrus skin exhibited in the Great Exhibition took no less than four years to tan; but Mr. Preller estimated that by his mode of treatment the conversion would be perfect in sixty hours, allowing six periods of agitation in the drum, each of ten hours' duration. The economy of time in the conversion of the hide is a circumstance strongly favourable to the practical working of the system, and is calculated to give to this branch of industry a degree of activity not hitherto experienced."

It is further stated that leather prepared thus, without tan, possesses greatly increased capacity for resisting the passage of water, combined with remarkable suppleness; so that for boots and shoes it is far preferable to tanned leather. "When ordinary leather," says our well-informed contemporary, from whom we borrow these particulars, "is boiled in water, it gradually hardens and becomes rigid; and if the operation be continued for half an hour, it will be found to have assumed a kind of woody texture, and to have become brittle. Some descriptions of leather, on the other hand, become converted into a mass somewhat resembling glue. When Preller's leather is tried in the same way, it gradually approaches to the condition of horn, but it requires several hours before that state is attained. In its ordinary condition, as before observed, it is remarkably supple, and that quality admirably fits it for being used in the soles of shoes; for the West and East Indies, in particular, this quality is highly advantageous, and for the supply of troops would probably be found to be attended with economy, and productive of comfort."

We can hardly over-estimate the importance of these facts to country gentlemen; for, if further experience shows them to be fairly stated, of which we have no reason to doubt, then it is clear that the timber on an estate will become seriously depreciated, and all valuations will have to be made upon an entirely new basis.

## HOME CORRESPONDENCE.

### ON THE IMPROVEMENT OF LEATHER.

Sir,—Dr. Lyon Playfair stated at our society, in Jan., 1852, in his very interesting lecture, "On the Chemical Principles involved in Manufactures, as indicating the necessity of Industrial Instruction," that the processes recommended by scientific men for improving the Manufacture of Leather, have been unable to satisfy the many physical conditions involved in the production of good leather;—that the use of terra japonica, divi divi, sumach, and other substitutes, containing a greater amount of tannin than oak-bark; and also the mechanical means, such as pressure or squeezing, for the purpose of hastening the absorption of tannin, and other appliances for accelerating the process, have failed to produce a better article, and had, at the best, but a doubtful success;—that the manufacturers have reverted to their (more than 1800 years) old traditional modes of preparation;—and that there is a wide chasm between the chemist's laboratory and the workshop, which has to be bridged over by the united aid of the philosopher and the manufacturer, who, if working together, may achieve great results; but they must act on a common plan.

It is now nearly twenty months since this combined action was recommended; but I am not aware that such a plan has been adopted, and doubt that it would be carried out successfully. The first step required towards producing an improved article is, to become acquainted with and acknowledge the faults of it as then manufactured. Will our tanners do this? I doubt it; and do not consider it surprising, that after the different useless attempts to improve leather by following the plans recommended by chemists and other scientific men, any further new modes of manufacture are declined, and the old plan of making leather by immersion in solutions containing tannic acid is pursued; although it is well known that the acid (which chemists consider requisite to produce the insoluble compound called by them tannate of gelatine, or leather) acts more injuriously upon the fibres of the skin in proportion to the strength in which it is applied; and that a weak solution, which acts powerfully during the first seven days on the surface, has not penetrated to the centre after two months immersion; so that the surface will be over-tanned by gradually increasing the strength of the tannic acid, and will become brittle and harsh before the internal substance is fully acted upon.

It appears to me more likely that those who are not tanners or chemists, and free from the opinion that an acid is indispensable for changing the nature of the skin, will meet with better success; but they must study the requirements of those who work up and use leather, and endeavour to produce qualities suitable for the different purposes to which the leather is to be applied.

The Society of Arts might assist this end by collecting such information, and causing experiments to be made, regarding the strength and other properties of leather. Appearance alone forms no guide in choosing a good article; and as colour or a glassy surface is the principal quality to be observed at an exhibition, more useful knowledge would be acquired if application was made to the authorities at one of the royal dockyards, where machinery for testing materials is at hand. The weights which metals, stones, and wood, will bear without breaking, and those which produce fracture, are well known; but I am not aware of any published statistics as regards the various kinds of leather, and particularly such as is suitable for driving bands, harness, hose, boots and shoes, and military accoutrements.

Such information would be very acceptable to engineers, mill-owners, and many others, and I hope that the Council of our Society will further the object in view.

I am, Sir,
Your obedient Servant,
A Member.

## PROCEEDINGS OF INSTITUTIONS.

Bicester.—The First General Meeting of the Literary Institution was held on Tuesday evening, the 20th inst. In the absence of the President, Captain Style, R.N., the chair was taken by the Rev. J. W. Watts. After the election of officers for the ensuing year, the report was read, from which it appeared that though the Society was only formed in February of the present year, it already numbered 173 members; 56 of whom were honorary, and 117 ordinary. The income was 67*l.* 5*s.* 1*d.*, and the expenditure had been 52*l.* 4*s.* 0½*d.*, leaving a balance in hand of 15*l.* 1*s.* 0½*d.* The number of volumes in the library was 400, and the number issued to members had been 1008. Evening classes have been held for the improvement of the members in Writing and Arithmetic, and a Philharmonic Class had afforded the opportunity to many of the members of improving themselves in the science of music. Four lectures, all of which were well attended, had been delivered during the session: "On the Fall of Jerusalem," by Mr. Hamilton; "El Dorado," by E. Watkin, Esq.; "Life of the Duke of Wellington," by the Rev. J. J. Irwin; and "Crusades," by the Rev. T. C. Whitehead. One concert was given by the members of the Philharmonic Class, and an Exhibition of Dissolving Views by one of the members, interspersed by suitable addresses from Rev. J. W. Watts, Rev. W. Ferguson, and others.

## TO CORRESPONDENTS.

*Drying Printers' Ink.*—"H. C. G." wishes to know whether there is any chemical solution (or otherwise) which could be applied to a sheet of paper, so as instantaneously to dry (or nearly so) the printers' ink when printed on it.

*Notice.*—Members, and others, who can furnish or obtain original information or suggestions on the subjects included in the Society's Premium-list, or other topics connected with the Society's various departments of operation, are invited to communicate the same to the Secretary, in as condensed a form as possible, for the purpose of being either read and discussed at the evening meetings, or inserted in the Society's weekly Journal. Anonymous letters cannot be attended to. All communications, whether the author's name is to appear or not, must be accompanied by the writer's name and address.

Members of the Society who do not receive the Journal regularly, are requested to give immediate notice to the Secretary; and, in order to prevent mistakes, they are particularly requested to signify any change which they desire to have made in their address, with as little delay as possible.

*Country Institutions.*—Correspondents who are so good as to send reports of proceedings of Local Institutions, are requested to forward them immediately after the Meeting to which they refer, and not later than Tuesday morning, if intended for insertion in the following Friday's Journal.

## MISCELLANEA.

Manchester Free Library. — This Institution, which was opened to the public on the 6th of September, 1852, has, in rather less than a year, issued in the Reference Library 61,488 volumes; Lending Library, 77,648 volumes; total issues, 139,136 volumes.

Products of Algeria.—The French Government is about to exhibit, at No. 6, Rue de Bourgoyne, a collection of articles from Algeria, consisting of cotton, silk, cochineal, corn, oilseeds, wool, timber, wine, sugar-cane, stuffs of various kinds, saddles, &c., &c.

Preservation of the Sheathing of Ships' Bottoms.—The French Minister of Marine has ordered experiments to be made at Cherbourg and Brest with some metal prepared by electricity, and with an amalgamation of mercury, which, it is said, resists oxidation, and remains, when used as a sheathing for ships' bottoms, perfectly clean, no matter in what sea, or during what length of time.

Electric Telegraph in Madras.—Mr. Kenrick, of Madras, announced, it is said, on the 1st of August. that from that date the Electric Telegraph would be in operation between Captain Biden's Office and the Observatory, a distance of somewhat less than five miles, the earth, or return circuit, making it double. He also states that he will now give attention to the completion of the Time Ball; and when all is perfect, he intends to bequeath the whole system to the community of Madras.

Monument to James Watt.—The Directors of the Watt Institution and Edinburgh School of Arts, have resolved to erect a monument to the memory of James Watt, in Adam-square, Edinburgh; and His Grace, the Duke of Buccleuch, has liberally presented to the Directors a splendid block of stone, weighing upwards of ten tons, and taken from the Granton Quarry, for the purpose. Mr. Peter Slater has been selected to execute the work. The statue will be eight feet high, representing the philosopher in a sitting posture, with a scroll in one hand and a pair of compasses in the other.

Steam Fire-Engine.—The prevalence and progress of destructive fires in America is, it may not be generally known, diminished very much by the use and application of what is known there as the steam fire-engine. In its form it is somewhat similar to a locomotive, throws upwards of a 200 feet jet, and about 2,000 barrels in an hour, in from one to six streams of water. The machine may be put in operation in five minutes, requiring four men and four horses, and is calculated, it is said, to do as much as six of the ordinary hand engines. At a fire in May last, at Cincinnati, of a large brewery, the engine discharged a cataract of 15,000 barrels of water in eight hours, and nothing but this could have saved the entire square in which the brewery was from destruction.

The Atlantic and Pacific Junction Railway.—Surveys for the great central railway route destined to unite the Atlantic and Pacific are proceeding. The surveyors have already reached the Great Colorado of the west, to which point the passage is found to be a continuous valley, good for railway and for settlement. The pass at present selected is curiously ascertained to be the primeval buffalo route across these wild regions, this route being adopted by the enterprising surveyors from a knowledge of the fact that if they follow it they will have a line direct "as the crow flies," the buffalo, it appears, having an instinct in finding his way by the nearest, most direct, and richest route.

Large Discovery of Metalliferous Ore in Turkey. — The Constantinople correspondent of the *Daily News* says that Messrs. Leahy, in the course of surveying for the contemplated railway, have found large fields of all kinds of metalliferous ore, viz., gold, silver, mercury, copper, lead, antimony, arsenic, and iron; and also coal, alum, salt, saltpetre, and sulphur, the annual produce of which has been calculated at four millions sterling. The gold has been found near Adrianople, in the plains formed by the earthy deposits, and in the ferruginous sands of the river Arda, and also on the slopes of Mount Pelion and Mount Ossa, in Thessaly, intermixed with extensive deposits of lignite. The silver and lead mines appear to be of most value, and of immense extent, particularly those of Mount Pelion, where more than 200 different galleries have been already opened, showing an amount of richness in mineral deposits almost fabulous. The lead mines of Mount Pelion are only three or four miles from the harbours of Zaora and Volo, and have an abundance of water power and fuel.

The Lawson Observatory.—Mr. Lawson, of Bath, having offered his collection of astronomical and meteorological instruments, valued at £10,000, and 1,000 guineas towards the formation of a permanent fund of £10,000 for the establishment of a Midland Counties Observatory, the Lords of Her Majesty's Treasury have expressed their willingness to recommend a grant of £2,000 in aid of the funds, provided the remaining £8,000 be raised by subscription. The offer of Mr. Lawson has been for some time before the public; but owing to his declining health, it has become necessary that an immediate decision on the part of the Committee as to their capability to comply with the terms of the bequest should be arrived at. The offer of Mr. Lawson is to be withdrawn on the 1st of October, unless the remaining sum is subscribed by that date. On Tuesday last the Committee had received as much as 7,700*l.*, leaving 2,300*l.* still to be collected in the last four days. Should this not be the case, the nation will lose a favourable opportunity of establishing an important public Institution, calculated to advance greatly the science of meteorology.

Growth of Cotton in Australia.—The Governor-General directs it to be notified that, with a view to encourage the cultivation of cotton in New South Wales, the following sums, which were provided for the purpose by the Legislative Council, but have not yet been awarded, in consequence of no specimens having been exhibited, will be given as premiums for the best samples of that article grown in any part of the colony, and exhibited in Sidney on or before the 1st of June, 1853, viz.:—1. For the best sample, weighing not less than 50lbs., £30. 2. For the second sample, weighing not less than 50lbs., £20. The particular qualities required are length, strength, firmness, and silkiness of staple, and brightness of colour. Proof will be required that the cotton wool exhibited is the produce of the colony by the certificate of a magistrate, or of some other known person of respectability. The samples are to be delivered at the colonial stores at Sidney, and the awards will be made by a board to be appointed by the Governor-General.—*Australian and New Zealand Gazette.*

The Coal Fields of New South Wales.—The *Australian and New Zealand Gazette* says, "Almost every great district in the colony has been ascertained to possess in abundance this great gift of Providence, and it is in positions, for the most part, of comparatively easy access. To the south, to the west, and to the north, it is to be found in our ranges in immense quantities, and when enterprise, the desire of gain, or the necessity of their position, shall spur the inhabitants of these districts into action, they will produce it with the like ease, in the like abundance, and with the like profit, that the people of the Hunter have done. Newcastle may, like her namesake at home, be the main source of the supply of the metropolis, and her position on the coast enables her to do so with great facility; but the coal mines of Bathurst will not only supply the domestic wants of the district, but by their very richness, combined with the other mineral wealth with which they are closely associated, they will, in course of time, like the Staffordshire mines in England, force into existence towns that will rival the Birminghams, the Wolverhamptons, the Bilstons, and the Dudleys at home."

New Plan for the Ventilation of Coal Vessels.—The frequent and lamentable explosions which have so often and recently occurred to the vessels and colliers engaged in the shipment of coal from tho Welsh ports, have caused the adoption of a most ingenious plan for the prevention of these accidents. Vessels proceeding on long voyages, laden with the Welsh steam and other coals, are now generally fitted after the new manner, and into such favour has it risen that it is deemed indispensable by the Liverpool commercial community that vessels engaged in the foreign coal trade should be fitted up on the improved system, which is done after the following manner. The great object is to prevent the accumulation of "foul air," and to do this a thorough draft or ventilation is gained by lining the hold, before the vessel is loaded, with sleepers, bearing alternately from the deck half way to the keel, and *vice versâ* from the keel upwards. These are four or five inches in depth, and three feet apart; and on them is laid a flooring, which passes the whole length of the hold, leaving the wide space underneath for the purpose of fresh air. This current is sent down from the decks by means of six wooden funnels, 12 or 18 inches square, which, placed perpendicularly, run two from the fore, main, and after decks each, down to the space left at the bottom of the hold, thus securing an uninterrupted passage for the fresh air. The inner surfaces are thus kept cool, and vessels on a six months' voyage need not apprehend any danger from explosion, as was formerly the case.

Time Signal Ball in the Strand.—Professor Airy has just issued the following notice to chronometer-makers and to the public: The system of dropping the Time Signal Ball on the buildings of the Electric Telegraph Company, 448, Strand, by a galvanic current from the Royal Observatory, Greenwich, having, after the experience of several months, been found perfectly efficient (interrupted only by occasional repairs of the apparatus), chronometer-makers and others are informed that when no extraordinary signal is exhibited, implicit reliance may be placed on the accuracy of the time given by the drop of the ball. The same galvanic current which liberates the ball in the Strand moves a needle upon the transit clock at the Royal Observatory. The time of movement of this needle is observed by the officers of the Royal Observatory, and duly registered, and is found to be sensibly correct. The time occupied by tho transmission of the galvanic current from the Royal Observatory to the Strand is about 1-3000th part of a second. The time occupied by the unloosing of the machinery which supports the ball is less than one-fifth part of a second. Chronometer-makers are requested to remark that the instant which is to be taken as truly corresponding to one o'clock, Greenwich mean solar time, is that of the commencement of the drop of the ball. In the event of accidental failure or error in the dropping of the ball at one o'clock, it will be raised half-mast high till two o'clock, when it will be dropped with the same accuracy.

Drainage of a Loch by means of a Syphon.—Culhorn Loch, in the county of Wigton, was drained, under the direction of the celebrated Marshal, Earl of Stair, more than 100 years ago, by a drain, or cut, some places thirty-six feet deep. That operation still left about eight acres of water, above sixteen feet deep in the centre, and fully twenty acres of marshy ground, which could not be drained without more fall than the whole cut could afford. This marsh had long been considered an eyesore, being immediately in front of Culhorn-house, a seat of the Earl of Stair; but the expense of deepening the outlet, in some places through quicksand, seemed so difficult and expensive, that although often talked of, the operation was never undertaken. The present Earl of Stair, some time before his accession, was anxious to drain the marsh; and having set his mind to consider various plans which were suggested, his Lordship appears to have succeeded by an operation which, it is believed, is new in the annals of draining, at least on so great a scale as in the present case, viz., by means of a large syphon. The syphon referred to is .880 yards long (exactly half a mile), and is seven inches in diameter. It has now drawn off nine feet deep of the water in the loch, which it is expected will give fall to enable the proprietor to drain properly the marsh already referred to, and to reduce the loch to an ornamental pond. The highest part of the syphon is twenty-one feet above the present surface of the loch, and the longest limb of the syphon is ten feet under the level of the water, giving ten feet of fall. The main part of the syphon consists of cast-iron pipes 5-8ths of an inch thick, with spigot and faucet joints very carefully joined and made air-tight with lead. The contract expense of the iron pipe laid, when complete, was 7*s.* 6*d.* per yard.—*Wigton Free Press.*

Inventors and Inventions.—"In the intellectual, as in the material world, the most precious productions are those which cannot spring to perfection at once; and it would be as reasonable to inquire to what refreshing shower, or to what gleam of sunshine, the stature of a stately oak is attributable, as to what individual mind we are indebted for the creation of our modern steam-engine. The exertions of different minds are merely so many agencies that have been happily conducive to a general result; and it would be as just to assign the invention of our modern men-of-war to Jason, as to assign the invention of the steam-engine to Savery or De Caus. * * * The steam-engine happens, no doubt, to be from first to last an English invention; but that result, we conceive, is not so much to be attributed to the superior genius of the English people as to the force of circumstances, which made some such instrument as the steam-engine more valuable to England than to other nations. * * * It is to the force of circumstances chiefly that the superior proficiency of the present age in such devices is to be ascribed; and we hold it vicious in principle to confound this impelling power with the ingenuity appertaining to particular inventors, and which Nature dispenses with wonderful uniformity to all generations. * * * The same wants generate so naturally the same expedients for their relief, that simultaneous discoveries and inventions become inevitable, and identical projects start up at different epochs without imitation under the force of similar circumstances. * * * Inventions sown in one age are ripened in another by the progress of events, but a multitude of agencies are necessary to the final effect—and of these the most important is Time. Individual projectors are merely like bubbles floating upon the waves of that majestic stream; though higher than the other aqueous particles around them, yet their altitude is not to be measured from the position of the lowest surface, and they are not the cause of the general exaltation."—*Bourne on the Steam-engine.*

Photography.—A discussion has taken place at the Academy, between MM. Arago, Biot, and Chevreul, as to the respective rights of Mr. Talbot, of London, and M. Niepce de St. Victor, as to the invention of photographic engraving on plates of steel. The processes of these chemists are different. Mr. Talbot uses, for the substance impressible to light, a mixture of gelatine and bichromate of potash, which is modified and browned on the immediate contact of light, and only where the light acts, whilst the part covered by the object to be copied remains untouched, and may always be removed by water. M. Niepce has aimed to perfect the process which his uncle, the inventor of heliography, described in the year 1827. The sensitive substance is a solution of bitumen in essence of lavender, applied in a layer; this varnish changes its properties while under the action of light. The parts exposed to the sun become insoluble in a mixture of essence of lavender and oil of petroleum, so that they may be easily separated from the soluble part not impressed, which represents the image to be reproduced. The liquid employed by Mr. Talbot for biting in on steel after his design, is bichloride of platinum, and that of M. Niepce, a mixture made of one part of nitric acid, eight parts of distilled water, and two of alcohol. We mention only these general facts, the details belonging more especially to the domain of technology.

**Locomotion by Compressed Air.**—The obstacles which have till now opposed the employment of the expansive force of compressed air will, it is thought, disappear through the process of M. Julienne, which consists simply in compressing air by means of an hydraulic press. By this method, M. Julienne substitutes for the *solid* piston—which a grain of sand may alter, which the slightest irregularity in the pump would throw out of action, and which becomes heated by friction—a liquid piston, not less incompressible than the other, filling always exactly the space in which it moves, be it regular or not, and acting by progression on a resistance so exactly calculated, that its proportion, although increasing, is always in relation to the force to be overcome. The air is thus compressed at thirty atmospheres in iron bottles, which are about four millimetres thick. It is perfectly preserved under this pressure; and it was with a bottle of this kind that M. Julienne put in action a small vehicle, carrying two persons, and moving with great rapidity.—*American Journal.*

## PATENT LAW AMENDMENT ACT, 1852.

### APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

*From Gazette, 23rd September*, 1853.

*Dated 12th August*, 1853.

1892. D. J. Picciotto, 8, Crosby-square, London—Improvements in weaving. (A communication.)

*Dated 24th August.*

1968. G. Culverhouse, 72, English-street, Hull—Manufacturing compost or manure.

*Dated 29th August.*

2002. P. A. le Comte de Fontainemoreau, 4, South-street, Finsbury—Apparatus for heating. (A communication.)

*Dated 8th September.*

2063. S. G. Pape, 34, Gloucester-crescent, Camden-town—Brace-ends, new suspenders for trowsers, &c.
2064. J. G. Lynde, jun., 37, Great George-street, Westminster—Pressure-governor, or self-acting apparatus for regulating flow of water.
2066. J. D. Brunton, Truro—Wind-guard or chimney-top.
2067. J. Petrie, jun., Rochdale—Cans for applying oil to machinery.
2068. J. Coate, 19, Marylebone-street, Regent-street—Tooth, nail, and hair-brushes.
2069. J. Burrows, Haigh Foundry, Wigan—Construction of rolled metallic plates.
1070. W. Hall, The Colliery, Castlecomer—Conversion of peat into charcoal.

*Dated 9th September.*

2074. J. H. Johnson, 47, Lincoln's-inn Fields—Apparatus for facilitating the acquirement of the art of reading. (A communication.)
2076. M. L. Parnell, The Strand—Construction of locks.
2078. J. Doyle, 17, Cambridge-terrace, Paddington—Ventilation of tents and marquees.
2080. C. Askew, 27½, Charles street, Hampstead-road—Improvements in baths.
2082. J. Amory, Boston, United States—Improvements in furnaces.
2084. H. Woodhead, Kingston-on-Hull—Spinning machinery.
2086. A. V. Newton, 66, Chancery-lane—Manufacture of gas-burner and gas-regulator. (A communication.)

## WEEKLY LIST OF PATENTS SEALED.

*Sealed 22nd September*, 1853.

699. Thomas Bouch, of Edinburgh—Improvements in signals.
708. Bernard Boyle, of Raven-row, Mile End—Invention of a centripetal flange.
709. Hesketh Hughes and William Thomas Denham, of Cottage-place—Improvements in pianofortes, organs, seraphines, and other like musical instruments.
717. Henry Webster and Edward Dawson Stones, of Sheffield—Improvements in the construction of gas-stoves.
726. Robert Hazard, of Lincoln's-inn Fields—Invention of a "Podombrosloutron," or an improved apparatus for either sponge or shower-bath, and all lavatory purposes.
731. George Robb, of Glasgow—Improvements in the manufacture of sulphuric acid, alkalies, and their salts.
733. George Oakes Asbury, of Birmingham—Improvements in the manufacture of dowls used in joinery.
773. George Hanson, of Huddersfield, and David Chadwick, of Salford—Improvements in apparatus for measuring gas, water, and other fluids; which improvements are also applicable for obtaining motive power.
882. Eliza Cunnington, of Devizes—Improvements in the decoration of furniture panels and other surfaces.
904. Joseph Adamson, of Leeds—Improvements in flushing apparatus and in water-closets.
928. Henry Wilks, of Rotherham—Improvements in cocks.
1023. William Reid, of University-street—Improvements in apparatus for testing the insulation of electric telegraph wires.
1389. Anthony Bernhard Baron Von Rathen, of Wells-street—Improvements in the mode of, and in engines for, applying motive power.
1480. James Hogg, junior, of Nicholson-street, Edinburgh—Improvements in the application and combination of glass, porcelain, stone ware, earthenware, terra cotta, composition in plaster, of the kind called scagliola, and majolica ware.
1487. Jacques François Dupont de Busaac, of Upper Charlotte-street—Improved mode of making, with iodine and its compounds, in combination with substances containing extractive principles, various elementary combinations.
1520. John Leach, of Over Darwen—Improvements in looms for weaving.
1535. Joseph Rock, junior, of Birmingham—Improvements in spring or clasp-knives, applicable to such other articles as shut or close after the manner of clasp-knives.
1554. William Fairclough, of Stockport—Improvements in looms for weaving.
1649. Henry Brougham Hopwood, of St. George-street East—Improvements in ships' ports or scuttles.
1687. Henry Bessemer, of Old St. Pancras-road—Improvements in the process of refining and manufacturing sugar.
1689. Henry Bessemer, of Old St. Pancras-road—Improvements in the manufacture and treatment of bastard sugar and other low saccharine products, such as are obtained from molasses and scums.
1691. Henry Bessemer, of Old St. Pancras-road—Improvements in the manufacture and refining of sugar.
1708. Peter Armand le Comte de Fontainemoreau, of South-street, Finsbury—Invention of a new mode of equilibrating indefinitely the weight of atmospheres. (A communication.)
1719. John Dent Goodman, of Birmingham—Improvements in lanterns.
1763. Alfred William Warder, of Sydney-street, Brompton—Improvements in gas stoves.
1764. Francis Arding, of Uxbridge—Improvements in threshing-machines.
1776. James Mackay, of Aigburth, near Liverpool—Improved apparatus for propelling vessels.
1790. John Gray, of Rotherhithe—Improved apparatus for consuming smoke.

*Sealed 24th September.*

716. Charles Victor Frederic de Roulet, of Paris—Improvements in the manufacture of piled figured fabrics, by alterations in, and additions to, looms for weaving; including also a warping-machine, with a method of reading and arranging the colours or materials for the patterns of such figured fabrics.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Title. | Proprietor's Name. | Address. |
|---|---|---|---|---|
| Sept. 22 | 3512 | Oscillating Safety-valve | Thomas Cowburn | Manager of the Eagley Foundry, near Bolton-le-Moors, Lancashire. |
| ,, 23 | 3513 | Portable Crochet Cotton-reel Holder | William Collimore | 2, Railway-street, Brighton. |
| ,, 24 | 3514 | Spring Bible and Prayer Case | Thomas Brindley | 2, Leonard's-square, Finsbury. |
| ,, 26 | 3515 | A Rib or Tooth of a Crusher or Crushing-Roller. | Joseph Chant | Bristol-road, Bridgewater. |
| ,, 28 | 3516 | Barlow's Registered Cinder-sifter | James Barlow | 14, King William-street, Mansion-house. |